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Adoption of Cabbage Cultivation Technology by the Farmers of Khordha District of Odisha, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Adoption of modern cultivation technology is crucial for the growth of agriculture and development of the farming community at large. Studying the adoption of a crop cultivation technology among farmers is helpful in devising appropriate extension strategies to improve the productivity of that crop. The study was undertaken to assess the adoption level of cabbage cultivation technology in farmers of Khordha district of Odisha and determine the factors that influence the adoption level. Ex-post facto research design was employed. The research was conducted in Balianta and Balipatna blocks of Khordha district of Odisha. A sample size of 120 respondents was chosen

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through simple random sampling from six villages. Data was collected using a pretested, structured interview schedule through personal interview and analysed using statistical tools. The findings revealed that majority (69.17%) of respondents had medium level of adoption, followed by high level of adoption (20%) and low level of adoption (10.83%) of cabbage cultivation technology. Correlation analysis found that socio-economic attributes such as age, educational qualification, land holding size, extension contact, experience in cabbage cultivation, mass media exposure, and innovativeness were positively and significantly correlated with the level of adoption of cabbage cultivation technology by respondents.

Keywords: Adoption; cabbage farmers; agricultural technology; cabbage cultivation; Odisha; horticulture.

1. INTRODUCTION

Agriculture forms the fundamental basis of India's economic structure. 70 percent of Indians have agriculture as the major source of their livelihood. Over many years, agriculture has contributed a lot towards the growth and development of India, contributing around 20.2 per cent to GDP in 2020-21 and 18.8 per cent in 2021-22. As a result, India has become a self-reliant, self-sustaining economy in terms of food security and economic development.

Horticulture makes up 30.4 per cent of the Gross Domestic Product (GDP) in agriculture while utilizing just 13.1 per cent of the total cropped area in India [1]. Being high value crops, horticultural crops have a total production of 319.57 million tonnes in just 25.66 million hectares area, with a productivity of 12.49 tonnes per hectare. The launch of the National Horticulture Mission (NHM) led to significant boost in the production of horticultural crops, nationally [2]. Consequently, the productivity in horticultural crops witnessed a substantial increase of approximately 38.5 per cent between 2004-05 and 2021-22 [3].

Among horticultural crops, vegetables have higher nutritional value, higher output, increased income per unit of land, are shorter in duration, high-yielding, and intensive in nature. India is the second-largest vegetable producer globally, utilizing 2.8 per cent of its total cropped area for vegetables and contributing 14 per cent to worldwide vegetable production. In 2021-22, vegetable crops in India yielded a production of 204.61 million metric tonnes [3].

Among the major vegetable crops grown in India, Cabbage (*Brassica oleracea var. capitata*) is a prominent cole crop of the Brassicaceae family that occupies maximum share in area and production, with a cultivation area of 398,500 hectares and a net production of 90.37 lakh metric tonnes, yielding 22.7 metric tonnes per hectare [3].

With the diffusion of innovation into the crop cultivation scenario, enhanced production can be achieved through adoption of the recommended cultivation practices. Adoption refers to the decision of making full use of an innovation as the best course of action possible [4]. Any technological innovation in agriculture can be termed successful only if the farmers adopt the recommended cultivation technology. Assessing adoption level of a crop cultivation technology among farmers is helpful in devising appropriate extension strategies to improve the productivity of that crop. Hence in the context of cabbage cultivation in various parts of India, adoption studies have revealed crucial findings. According to research conducted in Maharashtra by Sasane et al. (2012), 55 per cent of the respondents were having medium level of adoption of recommended technology followed by high and low level [5]. As per the study conducted by Sajeena et al. (2015) on vegetable cultivation in Kerala, it was reported that scientific practices of vegetable cultivation were embraced by just a fraction of the total respondents, ranging from 12.9 per cent to 46.3 per cent [6].

In a study undertaken by Thakur et al. (2022) on adoption behaviour of farmers with respect to vegetable farming, it was revealed that training, knowledge, proper budget, farm planning, and farm business appraisal were key factors mainly considered by the farmers while adopting the farm practices [7].

As per National Horticulture Board, Odisha is one of the leaders in cabbage production in India [8,9]. The production of cabbage in Odisha was 11,30,560 tonnes in 2021 in an area of 37,740

hectares, contributing 11.77 per cent to the national production [10]. Khordha district of Odisha is one of the leading districts in cabbage production in the state, producing 63,160 metric tonnes of cabbage [3].

But still, there has not been any prior research on adoption of cabbage cultivation technology in the district. Therefore, there was a need to assess the level of adoption of cabbage cultivation technology by farmers of Khordha district of Odisha. With this background, the current study was undertaken.

2. MATERIALS AND METHODS

The present study was conducted in Khordha district of Odisha, selected purposively. Ex-post facto research design was used, since the independent variables had already exerted their effects on the dependent variable. Multi-stage random sampling technique was used to choose the sample for study as given in Table 1.

Balianta and Balipatna blocks of Khordha district were selected purposively since they had more cabbage growers. From Balianta block, 3 gram panchayats were selected purposively, namely Jhinti Sasan, Purohitpur and Puranapradhan. Similarly, Garedipanchan, Somanasasan and Rajas gram panchayat of Balipatna block were selected. Finally, 6 villages (1 from each gram panchayat) were selected, through purposive sampling based on the area under cabbage cultivation. The villages were Jhinti Sasan, Chadheibara and Puranapradhan village from Balianta block and Garedipanchan, Somanapradhan and Rajas village from Balipatna block. From each village, a list of cabbage growing farmers was prepared, with help from the Block Agriculture Office. 20 cabbage growers from each of the 6 villages were selected through simple random sampling. Hence a sample size of 120 respondents was selected for primary data collection. The data were collected with the help of well- structured, pre-tested interview schedule via personal interview. The socio-economic attributes of the respondents were included in the interview schedule.

In the present study, adoption level was selected as the dependent variable. It was operationalized as the degree to which a respondent actually uses the recommended cabbage cultivation technology. The adoption level of respondents was measured by using a structured schedule which was prepared after considering the recommended package of practices in Khordha district. A total of 31 statements were framed. A three-point continuum scale was used to assess the adoption level, where a score of 3 was given for full adoption, a score of 2 was given for partial adoption and a score of 1 was given for no adoption. The total adoption score for each respondent was worked out. The maximum possible adoption score that could be obtained was 93.

Adoption level of respondents was quantified by using adoption quotient, calculated using the procedure followed by Sengupta [11]

> Adoption quotient = Total adoption score obtained by the respondent / Maximum possible adoption score obtainable by the respondent * 100

Based on the adoption quotient, respondents were classified into three categories using mean and standard deviation (S.D.) as shown in Table 2.

Table 1. Sampling framework of the study

Name of the district	Name of the blocks	Name of Gram Panchayats	Name of villages	No. of respondents
Khordha	Balianta	Jhinti Sasan	Jhinti Sasan	20
		Purohitpur	Chadheibara	20
		Puranapradhan	Puranapradhan	20
	Balipatna	Garedipanchan	Garedipanchan	20
		Somanasasan	Somanasasan	20
		Rajas	Rajas	20

Table 2. Categorisation of adoption level

Sl. No.	Adoption category	Basis of categorisation
1.	Low level of adoption	< Mean- S.D.
2.	Medium level of adoption	In between Mean ± S.D.
3.	High level of adoption	>Mean + S.D.

The data collected were tabulated and analysed through statistical tools like frequency, percentage, mean, standard deviation, correlation coefficient and the results were interpreted. Jamovi software was used for running statistical analyses [12].

3. RESULTS AND DISCUSSION

3.1 Socio – Economic Attributes of the Respondents

The socio-economic attributes of the respondents were studied and the data were tabulated. As indicated in Table 3, it was observed that majority (56.7 %) of the respondents belonged to old age, followed by 38.3 per cent in middle age and 5 per cent in young age group. 45 per cent of the total respondents had a high school degree, followed by 22.5 per cent with a higher secondary education, 17.5 per cent with a middle school education, 5.83 per cent with a graduate degree, and 5 per cent and 4.17 per cent who were functionally literate and had primary school education respectively. The findings were in line with those reported by Kachare [13]. Most of the cabbage growing farmers had a small family size (86.7 %), followed by 8.3 per cent with medium family and 5 per cent with large family. The reason behind this might be that a small family size has financial stability, supports better pooling of resources and is easy to sustain financially. As a result, only 13.3 per cent had a joint family whereas 86.7 per cent had a nuclear family. Similar results were obtained by Nayak and Banerjee (2022) in a study on vegetable growers in Odisha [14].

The results indicated that majority (79.17 %) of the respondents were engaged only in farming, followed by 12.5 per cent in farming and animal husbandry, 5 per cent in farming and business, 2.5 per cent in farming and service and 0.83 per cent in farming, business and service. Most of the respondents were engaged in farming because they were more accustomed to farming in general (cabbage cultivation in specific), and hence found it suitable to continue with it as their primary occupation as it can be continued with the local resources and traditional knowledge. It was observed that majority (56.6 %) of the respondents were marginal farmers, followed by small farmers (21.6%), medium farmers (12.6%) and landless farmers (9.2%). This was because of land fragmentation, leading to more marginal farmers. The findings were in conformity with the results of Ashok and Aski [15].

Most of the cabbage farmers had medium income (95%), mostly because they depended on farming for their livelihood and rarely engaged in other allied enterprises, which would have brought in larger revenue. The findings are in line with the results obtained by Pathade et al. [16]. 57.5 per cent of respondents had medium extension contact followed by 21.67 per cent with low extension contact and 20.83 per cent with high extension contact. Mishra and Ghadei (2015) also reported similar results [17]. As is evident, 62.5 per cent of respondents had medium experience, 20 per cent had high experience and 17.5 per cent had low experience in cabbage cultivation. Most of the respondents (70.84%) showed medium social participation, followed by high (15%) and low (14.16%) social participation. It was observed that 71.62 per cent respondents had medium level of mass media exposure, followed by low (19.17%) and high mass media exposure (9.21%).

The findings were in conformity with the results obtained by Kumari [18]. Most of the respondents had an average level of income, usually used sources like radio, television and newspaper to obtain information on modern agricultural technologies, but they did not often utilise extension literature or agricultural publications or social media to access information, except a few of the respondents. Therefore most of the respondents had a medium mass media exposure as opposed to a few with high mass media exposure. Majority of the respondents had medium innovativeness (67.5%), followed by high (20%) and low (12.5%) innovativeness, the reason being that most of them had an inherent nature of trying new innovations.

Table 3. Distribution of respondents according to their socio-economic attributes (n=120)

Sl. No.	Variables	Category	Frequency	Percentage
1.	Age	Young (less than 30 years)	6	5
		Middle aged (30-50 years)	46	38.3
		Old (above 50 years)	68	56.7
2.	Educational qualification	Functionally literate	6	5
		Primary school	5	4.17
		Middle school	21	17.5
		High school	54	45
		Higher secondary	27	22.5
		Graduate	7	5.83
		Above graduate	0	0
3.	Family size	Small family (<5 members)	104	86.7
		Medium family (5-8 members)	10	8.3
		Large family (>8 members)	6	5
4.	Family type	Nuclear family	104	86.7
		Joint family	16	13.3
5.	Occupation	Farming	95	79.17
		Farming + Animal husbandry	15	12.5
		Farming+ Labour	0	0
		Farming + Business	6	5
		Farming+ Service	3	2.5
		Farming + Business+ Service	1	0.83
6.	Land holding size	Landless	11	9.2
		Marginal (upto 1 ha)	68	56.6
		Small (1.1-2 ha)	26	21.6
		Medium (2.1-4 ha)	15	12.6
		Large (above 4 ha)	0	0
7.	Annual family income	Low income (<Rs 1610.27)	0	0
		Medium income (Rs 1610.27 to Rs 197373.05)	114	95
		High income (>Rs 197373.05)	6	5
8.	Extension contact	Low extension contact (< 12.47)	26	21.67
		Medium extension contact (12.47 to 19.3)	69	57.5
		High extension contact (> 19.3)	25	20.83
9.	Experience in cabbage cultivation	Low experience(< 5.65 years)	21	17.5
		Medium experience (5.65 to 14.8 years)	75	62.5
		High experience (> 14.8)	24	20
10.	Social participation	Low social participation (< 13)	17	14.16
		Medium social participation (13 to 16.7)	85	70.84
		High social participation (> 16.7)	18	15
11.	Mass media exposure	Low mass media exposure (< 10.85)	23	19.17
		Medium mass media exposure (10.85 to 15.12)	86	71.62
		High mass media exposure (> 15.12)	11	9.21
12.	Innovativeness	Low innovativeness (< 12.42)	15	12.5
		Medium innovativeness (12.42 to 18.47)	81	67.5
		High innovativeness (> 18.47)	24	20

3.2 Adoption Level of Cabbage Cultivation Technology by the Respondents

The adoption level of the respondents was studied and tabulated. As indicated in Table 4, majority (69.17%) of respondents had medium level of adoption of cabbage cultivation technology, followed by 20 per cent with high adoption level and 10.83 per cent with low adoption level. The finding is in alignment with the study conducted by Sharma et al. (2023) on adoption of natural farming practices by farmers in Himachal Pradesh, where it was revealed that 65.83 per cent of the total respondents had a medium level of adoption [19].

Majority of respondents had medium adoption because they were exposed to various training programmes, workshops on cabbage cultivation technology, and most of them had better innovativeness, better extension contact, and were willing to take risks and adopt modern practices. Yet some challenges existed related to the accessibility, affordability and availability of inputs, services and guidance which led to medium level of adoption. Similar results were also obtained by Sasane et al. (2012), Soni et al. (2013), Supriya and Ram (2013), Devi et al. (2014) and Rashid et al. (2021), stating that majority of respondents cultivating cabbage were under the medium level of adoption category [5], [20-23].

3.3 Relationship of Socio-Economic Attributes of Cabbage Growers with the Adoption Level of Cabbage Cultivation Technology

Under the present study, attempt was made to find out the nature of relationship between socio-economic attributes of cabbage growers with their level of adoption of cabbage cultivation technology, by computing the coefficient of correlation (r) for each of them. The data obtained was tabulated. As per Table 5, variables like age, educational qualification, land holding size, extension contact, experience in cabbage cultivation, mass media exposure and innovativeness were positively and significantly correlated with level of adoption of cabbage cultivation technology by respondents.

On the other hand, family size, family type, occupation, annual family income and social participation had no significant correlation with the level of adoption of respondents. The findings are in partial conformity with the results obtained by Behera [24].

Table 4. Distribution of respondents according to their adoption level of cabbage cultivation technology (n=120)

Sl. No.	Adoption level	Frequency	Percentage
1.	Low adoption level (<77.15)	13	10.83
2.	Medium adoption level (77.15 to 91.47)	83	69.17
3.	High adoption level (>91.47)	24	20
	Mean= 84.31	S.D.= 7.16	

Table 5. Correlation of level of adoption of cabbage cultivation technology by respondents with their socio-economic attributes

Sl. No.	Independent variables	Coefficient of correlation "r"
1.	Age	0.206*
2.	Educational qualification	0.49***
3.	Family size	-0.086 NS
4.	Family type	-0.035 NS
5.	Occupation	-0.087 NS
6.	Land holding size	0.31 ***
7.	Annual family income	0.14 NS
8.	Extension contact	0.43 ***
9.	Experience in cabbage cultivation	0.27 **
10.	Social participation	-0.12 NS
11.	Mass media exposure	0.507 ***
12.	Innovativeness	0.74 ***

Significant at 5% level of significance; ** Significant at 1% level of significance; * Significant at 0.001 level of significance; NS- Not Significant*

4. CONCLUSION

Based on the findings, it was concluded that majority of the cabbage growers in Khordha district of Odisha had a medium level of adoption of cabbage cultivation technology followed by high and low adoption. Adoption level of respondents was positively and significantly affected by age, educational qualification, land holding size, extension contact, experience in cabbage cultivation, mass media exposure and innovativeness. Therefore, better adoption of technology could be achieved by providing adequate, need based training to the farmers and spreading awareness among them regarding the advanced cultivation practices in cabbage. In order to improve the level of adoption of technology, individual as well as group based contact methods can be implemented by extension personnels through a suitable mix, so as to cater to the extension needs of the respondents. This would increase their extension contact. Farmer fairs can be arranged at block levels to achieve community spread of the technology at a faster rate. Modern community based mass media approaches can be used by extension personnels to facilitate easy formation of groups like Farmer Producer Organisations, Commodity Interest Groups which would lead to an increase in social participation of respondents. This would further increase their information seeking attitude and mass media exposure, thereby facilitating better adoption of agricultural innovations. Suitable media mix strategies could be adopted as well. More frequent training programmes on cabbage cultivation, workshops, and exhibitions can be organised by the block and district level officials and extension personnels to spread awareness among the farmers regarding the benefits of growing cabbage. Farmer Field School concept can be applied to increase the adoption of advanced cultivation practices in cabbage. Agri-clinics could be set up in various remote locations of the district so as to facilitate remote delivery of consultancy services to farmers on cabbage cultivation technology.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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